Be a Solid Waste Survivor

Take the Citizenship Challenge

An Middle Grades Unit of Study for Kentucky Schools

Be A Solid Waste Survivor—Take the Citizenship Challenge
Middle Grades

A KENTUCKY ENVIRONMENTAL EDUCATION COUNCIL
PRACTICAL LIVING, SCIENCE, AND SOCIAL STUDIES INTEGRATED UNIT

Standards

Science

S-M-3.5.2, Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Social Studies

SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.

SS-M-4.4.4
Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).

Practical Living

PL-M-3.1.5
Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing).

PL-M-3.3.2
Improving environmental conditions (e.g., air and water quality) and preserving natural resources impacts personal and community health.

PL-M-3.3.1
A range of resources and services are provided by community agencies:

- public health department
- fire department
- police department
- family resource centers
- hospitals
- nonprofit organizations (e.g., American Heart Association, American Red Cross, American Cancer Society)

Unit Overview	
Lesson	**Title and Description of Activities, Essential and Guiding Questions and Standards**
#1	**"Family Values"** – Students will explain how they and their families currently dispose of all solid waste at home. They will also begin to think and talk about what they perceive as current natural resource and solid waste issues. **Standard:** Social Studies SS-M-4.4.4 **Essential Question #1:** How do people in my state and community develop their beliefs and perspectives on natural resource and solid waste issues? **Guiding Question:** ♦ How do my family's traditions history affect how we deal with solid waste?
#2	**"When I Was Young"** -- Students will learn how solid waste disposal has changed over time by interviewing older adults from the community. **Standard: Social Studies** SS-M-4.4.4 **Essential Question #1**: How do people in my state and community develop their beliefs and perspectives on natural resources and solid waste issues? **Guiding Questions**: ♦ How do my family's traditions and history affect how we deal with solid waste? What roles do such factors as media and peer pressure, packaging and convenience affect how we generate solid waste?
#3	**"A Growing Concern"** – Students will learn about geometric growth patterns, especially in world population, about diminishing natural resources, and the increasing production of solid waste. **Standard: Science**, S-M-3.5.4 **Essential Question #2**: How do human actions concerning solid waste management in my community and state affect the balance of ecosystems? **Guiding questions**: ♦ How does the improper disposal of solid waste affect Kentucky's ecosystems? ♦ What are the health, environmental and political consequences of improper waste disposal?
#4	"**Enviroscapes**" – This activity uses an Enviroscape tabletop model (which can be borrowed from a variety of sources) to help student's learn how watersheds become polluted and what can be done to prevent such pollution. **Standard: Science**, S-M-3.5.4 **Essential Question #2**: How do human actions concerning solid waste management in my community and state affect the balance of ecosystems? **Guiding questions**: ♦ How does the improper disposal of solid waste affect Kentucky's ecosystems? ♦ What are the health, environmental and political consequences of improper waste disposal?

	Unit Overview
Lesson	**Title and Description of Activities, Essential and Guiding Questions and Standards**
#5	"**Solid Waste Detectives**" – students use scientific ways of thinking and knowing to investigate hypotheses about solid waste in their communities. **Standard: Social Studies,** SS-M-4.4.4, **Practical Liv**ing, PL-M-3.1.5 **Essential Question #1**: How do people in my state and community develop their beliefs and perspectives on natural resources and solid waste issues? **Guiding questions**: • How does the improper disposal of solid waste affect Kentucky's ecosystems? • What are the health, environmental and political consequences of improper waste disposal?
#6	**"Out of Sight, Out of Mind"** – Students learn about karst topography and how improper disposal of solid waste can pollute underground water sources. **Standard: Science:** S-M-3.5.4, S-M-3.5.2 **Essential Question #2:** How do human actions concerning solid waste management in my community and state affect the balance of ecosystems? **Guiding questions:** ♦ How does the improper disposal of solid waste affect Kentucky's ecosystems? ♦ What are the health, environmental and political consequences of improper waste disposal?
#7	**"Trash Town"** – Students learn about the costs involved in waste management. **Standard: Practical Living**, PL-M-3.1.5 **Essential Question #3** – How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste management? **Guiding Question**: ♦ What are the health, environmental and political consequences of improper waste disposal?
#8	**"In Business for Yourself"--** Students interview local business people in order to learn how different businesses deal with natural resource and solid waste issues. **Standard: Practical Living, PL-M-3.1.5** **Essential Question #3**: How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste? **Guiding Question:** ♦ What decisions has your community made about solid waste? ♦ Have other communities made other decisions?
#9	**"Getting to Know Us"** – By conducting a panel discussion with people involved in their community's solid waste program, students learn about how their community deals with solid waste and about how they personally can help reduce solid waste. **Standard**: **Social Studies, SS-M-1.3.2, Practical Living, PL-M-3.3.1** **Essential Question**: How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste?

	Unit Overview
Lesson	**Title and Description of Activities, Essential and Guiding Questions and Standards**
#9	**"Getting to Know Us" cont.** **Guiding Questions:** ♦ What state and local agencies are sources of accurate and current information on Solid waste management? ♦ What other sources and services are available? ♦ What decisions have your state and community made about solid waste management?
#10	"**Surviving through Service**" – A Culminating Event. In this culminating activity, groups of students plan and implement a community service project related to solid waste. All standards are covered and information gathered on all essential and guiding questions may be used.

Integration

Language Arts

- Keep a journal of your family's solid waste habits.
- Read Little House on the Prairie or Hatchet to see different ways of thinking about waste and reusing natural resources.
- Write a story about a molecule that is dumped into a sinkhole, and what the molecule might see along the way as it travels through the water system
- Create a brochure that lists all the resources in the state and community that help people deal with solid waste.

Technology

- Create a web page that lists all the resources in the state and community that help people deal with solid waste.
- Use a global positioning instrument to find the highest point in the watershed directly around your school.
- Take digital photos of littering and illegal dumps in your community. Put these into a Power Point presentation to show at a meeting of the city council or solid waste board.

Arts and Humanities

- Use interviews of older people in the community (from the activity, "When I was Young") to create a skit that shows a typical day in the life of a person your age, 60 years ago.
- Make a mural of how illegally dumped solid waste gets into streams and rivers
- Do a photo essay of the most beautiful places in your community. Provide a copy to your local tourist bureau.

Integration (cont.)

Math

- Using the Internet, find an estimate of the total amount of trash produced by the average American each day. Then find the same estimates for at least six other countries. Make sure some of the countries are in the third world. Make a chart illustrating your findings.
- Do a genealogical chart of your family. Find out the total number of children each set of your great grandmothers had. Assume that each of those children had two children and each of those children had two children, etc. How many children in your generation would be descended from your great grandmothers. Multiply that number by the average amount of trash produced by an American each year.

Science

- With a parent or other adult, walk (or boat) along a local stream or river. Keep records of the kinds of trash you see. Write a hypothesis about how each kind of trash might affect the wildlife in that stream. Contact the Kentucky Department of Fish and Wildlife and discuss your hypotheses with a biologist. Their website address is <http://www.state.ky.us/agencies/fw/index.htm>
- With your parents' permission, dig a hole in your backyard. Place bits of solid waste in the hole. These should include (at least) food scraps, plastic, aluminum, grass clippings and paper. Keep a record of what you bury. Wait one year and dig the hole again. What is left?

Social Studies

- Locate all the landfills in Kentucky. Remember, landfills are legal places to dispose of solid waste. Contact the Division of Waste Management for assistance. (Their website is <http://www.nr.state.ky.us/nrepc/dep/waste/dwmhome.htm>). Using a Kentucky road map, figure out how far your school is from the nearest landfill.
- Have a discussion with your family about whether or not they think there should be penalties for dumping trash illegally

Family Values

Standard

Social Studies: **SS-M-4.4.4**
Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).

Activity

Students will learn how they and their families currently dispose of all solid waste at home. They will also begin to think and talk about what they perceive as current natural resource and solid waste issue.

Materials

Questionnaire Form (included)

Length of Lesson

One half hour the first day to go over the form and add questions if desired, one–two hours a second day to assemble information from all the questionnaires

Vocabulary Words

Solid waste— wastes such as containers and packaging, food scraps, yard trimmings, and miscellaneous inorganic wastes from households, and some commercial establishments.
Compost—a crumbly, earthy decomposing organic matter (e.g., leaves, food scraps) created in a controlled environment.
Recycling—collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.
Dumps—site where waste is disposed of in an unmanaged, uncovered area. Current landfill restrictions have made dumps illegal.

Essential Question

How do my family's traditions and history affect how we deal with solid waste?

Skills Used

Research, communication and analysis

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Family Values, cont…..

Activity

Step 1: Tell students that every family deals with solid waste differently depending on where they live, how they have gotten rid of trash in the past and how much solid waste they have. Tell them that they are going to ask questions about how their families deal with solid waste. Explain what a questionnaire is and tell them they will ask their families questions about solid waste and also observe what their families do with solid waste. Explain that after they have gotten answers to the questions, all the information will be brought into class and assembled. Tell the students that the answers are entirely confidential. (You might want to explain how questionnaires are used in a variety of contexts.)

Step 2: Pass out the questionnaire forms and go over the questions with the students. Ask if students would like to add any questions to the questionnaire. Tell them not to put their names on their questionnaires since they will be confidential.

Step 3: Give students at least a week to fill out and return questionnaires. When all questionnaires are returned, a teacher should put all the data together in aggregate form, and then dispose of the original questionnaires. When data has been aggregated, have students use the data to get answers to the following questions.

- How many bags of trash does the average family produce each week?
- What percentage of families has curbside collection?
- What percentage of families dispose of any waste themselves (by burning, composting, etc.)
- What percentage of families recycle any of their waste?
- What type of trash makes up most of the solid waste produced by the families in the class?

Assessment

Since this is an introductory lesson, there is no need to do a formal assessment although you may want to make sure each student has completed the analysis and understands the questions

Extensions

1. Encourage students to start a journal examining how people in their community deal with solid waste.
2. Have students keep lists throughout the unit of all the different kinds of things their families throw away.

Family values, cont…

Solid Waste Family Questionnaire

Note to teachers and students: These questions can be used to find out how families in your class deal with solid waste. The purpose of the questions is simply to gather information on how ALL families deal with ALL solid waste, not how a particular family does. Make sure all questionnaires are anonymous and that no one puts their name on the questionnaires.

Question #1: Does our family have curbside garbage collection?
___Yes
__ No

Question #2: If there is no curbside collection, where does our family take its garbage?
(Check all those that apply)
___ designated dumpsters
___ local dump
___ centralized trash collection
___ other

Question #3: About how much trash does our family produce each week as measured in large 30 gallon plastic bags.
_____ bags. (If your family uses another size, see how much each bag holds and translate that into 30-gallon size - e.g. three, 10-gallon bags equal one, 30-gallon bag. No need to be exact. We are only getting estimates.)

Question #4: Does our family use any other method to deal with waste? (check all that apply)
___ burn
___ recycle
___ compost
___ other

Question #5: What do people in our family do with large items they no longer need such as refrigerators or automobiles?
___ call local officials to get them picked up
___ take them to a landfill or other similar site
___ other

Question #6: What material makes up MOST of our family's trash?
___paper (boxes, diapers, newspaper)
___plastic (milk jugs, butter tubs)
___food scraps (potato peels, leftovers)
___metal (cans, pie plates)
___other

"When I Was Young . . ."

Standard

Social Studies: SS-M-4.4.4, Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).

Activity Description

Students will learn about how solid waste disposal has changed over time by interviewing older people from the community.

Materials

Interview questionnaire (to be developed by students)
Pencil and extra paper.

Length of Lesson

Approximately one to two hours in class plus a homework assignment.

Vocabulary Words

Recycling—collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.
Reuse—a type of source reduction activity involving the recovery or reapplication of a package, used product, or material in a manner that retains its original form or identity.

Essential Question

How do people in my state and community develop their beliefs and perspectives on natural resource and solid waste issues?

Guiding Questions

How does my family's traditions and history affect how we deal with solid waste?
What role do such factors as media and peer pressure, packaging, and convenience affect how we generate solid waste?

Skills Used

problem solving, research, communication

Activity

Step 1: Review the meaning of the vocabulary words with students. (For more background information refer to the **Teacher Fact Sheets** found at the beginning of this publication.)

Step 2: Explain to students that they will be writing and conducting an informal survey with older people (at least 70 years old) from the community. Explain that the intent of the survey is to try to determine how buying habits and solid waste disposal have changed over the past 75 years. Tell students that our society has not always produced so much solid waste. At one time, especially in rural areas, people produced much of what they used. This meant that they did not buy things in packages. Also such items as plastic and styrofoam were not widely used until after WWII.

Step 3: Encourage students to think of their own daily lives and how those lives would look if they rarely went to the store. Ask them to create a set of questions that they might want to ask older people about their early lives and how they dealt with solid waste. Make sure the questions are open ended enough to encourage older people to talk to the students.

"When I Was Young . . .", *continued*

Step 4: After students have completed writing the survey questions, give them the letter to parents (attached) and make sure they take the letter home. Tell students that they should have their parents help them decide whom to interview. Give students several days to complete the interviews.

Step 5: When all students have completed the interviews, allow them to share their findings with other students. Talk about how their lives are different from how older people lived when they were young. How has the way we deal with solid waste changed? What can we learn from older people in our community that will help us do a better job dealing with solid waste issues.

Ideas for survey questions

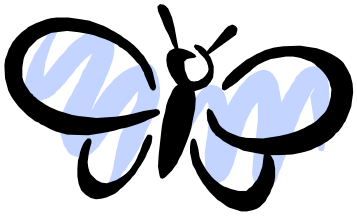
1. When and where were you born?
2. Did you grow up in a rural or urban area?
3. How did your family make a living?
4. Did your family produce as much trash as families do today?
5. If, not can you explain why?
6. Where did you get clothing and food?
7. Did you take your lunch to school? If so, what did you wrap it in.
8. Did you eat out? If so, how was the food wrapped?

Extensions

1. Have students videotape interviews and edit tapes to do a presentation to other classes, a nursing home, etc.
2. Have students read Little House on the Prairie or Hatchet and write answers to these questions. How did the characters in these books use natural resources? Did they produce a lot of solid waste? Why not?

Assessment

Ask students to make a list of the things they have in their homes that the older people they interviewed did not have in their homes when they were growing up. Have them also list what kind of packages these things came in.



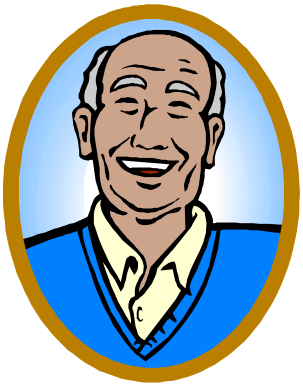
Dear Parents:

We are studying how our community deals with solid waste. This week, your child has helped design a questionnaire the whole class will use to interview older people in our community about how they lived and how they dealt with solid waste when they were young. We would like for each student to interview someone who is at least 70 years old. They may or may not have lived in your community or county for their whole lives but they should live in the community now.

Could you please help your child identify someone to interview and then help them contact that person. Make sure the person to be interviewed knows that the interview will take at least a half an hour. If your child has decided to tape or video the interview, make sure they have the permission of the person they interview.

Thank you for helping your child with this assignment. Please call me if you have questions.

Sincerely yours,



A Growing Concern

(Adapted from "Waste a Hidden Resource in Kentucky")

Standard

S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Activity

Students will learn about geometric growth patterns, especially in world population, about diminishing natural resources, and the increasing production of solid waste

Materials

Peanuts or pistachios, a clear bowl, pencils and paper, newspapers

Length of Lesson

1 hour

Vocabulary Words

Natural resources, consumption, renewable, nonrenewable, geometric, arithmetic

Essential Question

How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?

Skills Used

Calculation, research, analysis

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A Growing Concern, continued

Activity

Step 1: Explain to students the difference between arithmetic and geometric growth. Begin by having students compare the following sets of numbers and filling in the missing numbers in each series.

2-4-6-8-10-12__ __ __ 20
2-4--8-16-32-64 __ __ __ 1024
Have the students use the equations 3(n+1) and 3 _____ to generate values for n=1,2,3,4, and 5.

Step 2: Have students fill in genealogical charts to see how population grows exponentially. Talk about population growth. Have students visit some population growth websites. (Note: many of these websites talk about birth control. You should judge the maturity level of students before making this assignment.)

Step 3: Tell students that they are going to participate in an activity that simulates the geometric use of natural resources and the production of solid waste.

Place three students in the front of the room. Put one hundred peanuts (or pistachios if any student in the class is allergic to peanuts) in a clear bowl on a table in the front of the room. Also on the table, place another clear bowl or a newspaper.

Have each student take two peanuts, eat them and put the shells in the other bowl or on the newspaper. Repeat this in groups of 3 until all students participate (and all get peanuts!)

Step 4: Repeat step 3, starting again with one hundred peanuts and 3 students. (Empty shells into another container and save.) As before, have the first 3 students eat 2 peanuts and place the shells in the bowl or on the newspaper. However, when the second set of 3 students comes up, have each one take 4 peanuts. The next set takes eight; the next set takes 16 and so forth.

Lead the class in discussing how the second demonstration was different from the first. Tell them that the peanuts represented natural resources and the shells represent solid waste. Help students define renewable resources and nonrenewable resources. Ask the students to think about what it means that we have a growing world population AND a growing use of natural resources and solid waste.

Step 5: Ask students to imagine that everyone in their town had shared the peanuts and left the shells on the table. How would they dispose of the "solid waste"? Brainstorm different ideas and what the results of each idea might be.

Step 6: Bury some of the shells on the school grounds as compost. Ask students what they think will happen to the peanuts. Ask students if all solid waste will biodegrade?

Step 7: If there is a safe place to do so (such as a science lab) burn the shells. Place some of the ashes in a beaker of water and stir. Ask students if they would like to drink the water with the ash in it.

A Growing Concern, continued

Assessment

1. Have students define renewable and nonrenewable resources and give three examples of each.

2. Ask students to begin with the number 8 and write down the next six numbers that show arithmetic growth and the next three numbers that represent geometric growth. (Students may need calculators for this exercise)

3. Tell students that you can see into the future and you know that each of them will have two children and that each of those children will have two children and each of those children will have two children. How many great-grandchildren will each of them have?

Journal activity

Tell students that, because of overpopulation, China has a one-child policy. Couples that have only one child receive rewards in the form of special benefits for their child but couples that have more than one child are sanctioned. Sanctions may include the loss of jobs for the parents.

Ask students to write an essay saying why they think China has such a policy and giving their opinion of this policy. Tell them to support their opinion.

Extension

Have students write a skit in which ten people are working in an office 10X10 feet square. Each person produces 30 sheets of waste paper a day but there is only one very small trashcan that is emptied once a week.

The skit should show how they deal with the trash and how well they get along with each other in such small space.

Tell students that in many parts of the world, people actually live in spaces this small.

Enviroscapes

Standard

S-M-3.5.2, Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.
S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Activity

Students use a tabletop Enviroscape display model to visually see how improper solid waste disposal can affect surface and ground water.

Materials

An Enviroscape model, small bits of newspaper (See box on the following page for where to borrow a model.)

Length of Lesson

Approximately 1 hour.

Vocabulary Words

Sinkhole, watershed, nonpoint source pollution, Enviroscape, biodegradable, tributary

Essential Question

How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?

Skills Used

Observation, problem solving, communication

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Enviroscapes, continued

Activity

Step 1: Borrow an Enviroscape tabletop display unit. (See box below for where to borrow a model.) These units are models of a small community, including a farm, subdivision, forest, sewage treatment plant, factory, and construction site. The model is contoured and a stream runs through the entire "watershed".

By sprinkling dry tempura paint or powdered soft drink mix on the model and then making it "rain" with a spray bottle of water, students can easily see how nonpoint source pollution gets into our water. (See www.enviroscapes.com/ for more information.)

Step Two: Follow the easy directions on the model to show students how rainwater flows down hill and carries material with it into streams, rivers and ground water. Use small bits of newspaper to show how solid waste is also distributed in watershed.

Step 3: Allow students to work with the model in small groups and experiment with putting the solid waste (bits of newspaper) on different parts of the model. Since this activity uses kinesthetic learning, make sure all students get to spray water, place "trash" etc.

Step 4: Have students clean the model and put it away neatly so it can be returned and used again by another class.

Assessment

Give each student a map of the watershed in which his or her school is located. (See www.kywater.org/watch/ky.htm)

Ask students to mark the headwaters of this watershed. (They may need a little help seeing which way the water flows.) Tell them to imagine that an empty milk jug is thrown into their watershed at the headwaters. Tell them to try and draw a line from where the jug enters the watershed to where it would end up if nothing stopped it.

Have each student count the number of tributaries along the river. Ask them to explain in writing what would happen if people along all the tributaries of the river threw all their milk jugs in the waterways.

Where to borrow an Enviroscape

Enviroscape models are very expensive. Therefore schools rarely own them. However, there are many places to borrow them. These include some local Cooperative Extension and Natural Resource Conservation Service offices, the Division of Water and the Kentucky Environmental Education Council's (KEEC) resource schools. To find the address and phone numbers of these offices, go to the KEEC website, www.state.ky.us/agencies/envred/ or call, toll free, 800 882-5271.

Solid Waste Detectives

Standard

SS-M-4.4.4, Individual perspectives impact the use of natural resources (e.g., watering lawns, planting gardens, recycling paper).

PL-M-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing).
Academic Expectation 2.1

Activity

Students use scientific ways of thinking and knowing to gather information and suggest solutions to local solid waste problems. Many students may need some help from family members with their investigations. Teachers may choose to let each individual student do a project or divide the class into small groups.

Materials

Depending on students' choice of research projects, materials may include notebooks and pencils, computers, cameras, calculators, maps

Length of Lesson

At least two hours in class plus time at home to gather information.

Vocabulary Words

Hypothesis—An explanation accounting for a set of facts that can be tested by further investigation.
Data—Information organized for analysis.
Evidence—The data on which a conclusion may be based.
Investigation—To observe or inquire into in detail.

Essential Question

How do people in my state and community develop their beliefs and perspectives on natural resource and solid waste issues?

Skills Used

Formulating hypothesis, gathering data, conducting investigations, communicating results

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Solid Waste Detectives, continued

Activity

Step 1: Tell students they are going to become scientific detectives in order to find out about solid waste problems in their community. Explain to them that scientists and social scientists use a process to come up with answers to questions they have and to problems they want to solve. Tell students they are going to be following the same process (sometimes called the scientific method) to come up with their own ideas for solving solid waste problems.

Step 2: Go over Academic Expectation, 2.1 (Scientific Ways of Thinking and Knowing) with students and let them ask questions and begin to get an understanding of this process

Step 3: Ask each student (or group if you have chosen to do the activity as a group project) to write several hypotheses about solid waste issues in your community, which he or she (or the group) would like to investigate. You may need to prompt students with ideas.

Step 4: Work with students to make sure they have hypotheses that can be investigated with the tools and skills they have. Send a note home to parents letting them know what you are doing and that their student may need help gathering data for this project

Step 5: Have students begin to gather data. Be available to help them think through the kinds of data they need and the best way to gather it. Ask the librarian to visit your class and help students find data sources.

Step 6: Once students have gathered data, allow time in class in which to analyze the information and placed it in a graph, chart, essay, power point or other communication tool.

Step 7: Using the data they have analyzed, have each student come up with an idea to help reduce solid waste problems in your community.

Step 8: Hold a "Solid Waste Detective Fair" in the classroom so students can share their findings and ideas. Invite parents and the people students have interviewed during the unit.

Possible ideas for hypothesis

1. Some roads and streets in my community have more litter than others.
2. The majority of material in the landfill used by my community is glass.
3. People in my community dispose of less trash than the average American.
4. People in my community produce more trash than people in Germany.
5. More aluminum cans are recycled in my community than any other material.

Solid Waste Detectives, continued

Sample Model for Investigation

Fast Food Investigation

Form Hypothesis: People eating at fast food restaurants use more paper products than they actually need.

Collect data: Take a pencil and notebook to a local fast food restaurant on at least two different occasions. Go during a busy period such as dinner. Make sure you have a parent or other adult with you. Tell the manager that you are studying how people deal with solid waste and you would like to observe how many napkins, etc. people pick up. Tell him or her you will be sure not to disturb the customers.

Once you have permission, sit near the area where people get napkins, straws, etc. For a set amount of time (half an hour to an hour) observe people picking up napkins, straws, ketchup, lids and other paper or plastic products. Try and count how many of each item each person picks up and how many people are in their party. You will not always be able to get an exact count but make an effort to get as close a count as possible without disturbing the customers or letting them know you are counting. (Remember, if they know you are observing them, it is likely to change their behavior!)

Be sure and write down an identifying number for each person, how many people in their party and how many of each item they take. Have the person with you take down each person's approximate age and their gender. It will be helpful if you have a data-collecting sheet such as the one below.

Person ID	# in party	Approx. Age	Gender	#straws	#condi-ments	#sugar/ sweetener	#napkins	Other Observations
#1	3	35	F	6	12	0	10	
#2	1	60	M	0	0	4	3	Coffee only
#3	4	25	M	8	15	6	10	2 small kids
#4	5	70	F	3	4	3	5	

At the end of the time period, thank the manager and go to a quiet place and make sure your information is written clearly enough that you will be able to understand it later.

Solid Waste Detectives, continued

Sample Models for Investigation

Fast Food Investigation (cont.)

Conduct Analysis: Look at the data you have gathered. Answer the following questions.

- Look at the each person you observed. How many of them took more paper/plastic products that they actually needed? What percentage is this of the total number of people you observed?
- Ask the same questions about the males you observed. About the females you observed.
- Ask the same questions about people over 40 and people under 40.
- Count the total number of people who were using the paper/plastic products (total number in all parties) and the total number of napkins taken. Approximately how many napkins is that per person.

Communicating your results. Make a chart showing the results of one or more of the questions you have asked or do a PowerPoint presentation showing your results. A chart might look like the one below.

	All Males	All Females	All Under 35	All Over 35	Whole sample
Percentage of people taking more napkins than they needed	28%	76%	62%	31%	65%
Percentage of people taking more straws that needed	27%	75%	65%	42%	52%

Review hypothesis: Look at your original hypothesis. Based on the data you collected, was it correct or incorrect?

Based on your findings and your original hypothesis, what might be done to reduce solid waste at local fast food restaurant?

Out of Sight, Out of Mind

(Adapted from "Waste a Hidden Resource in Kentucky")

Standard

S-M-3.5.2, Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers because they make their own food. All animals, including humans, are consumers, and obtain their food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

S-M-3.5.4, The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition). Given adequate biotic and abiotic resources and no diseases or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Activity

Students make models of sinkholes to learn about karst topography and how improper disposal of solid waste can pollute underground water sources.

Materials

For every four students, have the following materials: One can of sliced beets and juice; eight, 2-liter bottles; two, 3" long pieces of 1"diameter tubing, limestone gravel; soil; a small piece of sod; water; cellophane tape; scissors; copies of student pages (attached).

Length of Lesson

Approximately 1-_ hours.

Vocabulary Words

Sinkhole—A natural depression in a land surface communicating with a subterranean passage.
Watershed—A region draining into a river, river system, or body of water.
Nonpoint source pollution—Water pollution that comes from many diffuse sources.

Essential Question

How do human actions concerning solid waste management in my community and state affect the balance of ecosystems?

Skills Used

Observation, communication, problem solving, following directions

****

Out of Sight, Out of Mind, cont**…**

Activity

Step 1: In this activity, students will "build" sinkholes to demonstrate how improper disposal of solid waste gets into our drinking water. Divide the students into teams of four. Ask each team to help assemble the materials for the lesson. (Note: You may buy sod at a local nursery, or, since you will only need about one square foot for the whole class, ask if you can dig it up on the school grounds and then reseed it when you are through. (Reseeding and watering are good lessons in horticulture for students).

Step 2: Give each team of students the demonstration page and make sure they have all the materials they need. Ask each team to complete parts 1-3. Have each team prepare a chart for recording their results.

Step 3: Ask each team to predict the outcome of the demonstration and record their predictions. Complete part four of the instructions and record results on prepared charts. Ask each team to arrange its bottles from least to most polluted.

Step 4: Ask groups to answer the following questions and record their answers.

- ✓ Have the bottles for each team been rank ordered the same?
- ✓ Was the change in water color the same for each group?
- ✓ How did the water in bottles A and C compare?
- ✓ If they were different, what might have accounted for the difference?

Assessment

As a homework assignment, ask each student to do the following (some research will be required).

- ✓ Look for waste that has been dumped into a stream or river near where you live. What kinds of trash were dumped? Write a paragraph describing what one of these types of waste might do to the water system.
- ✓ Find out in which river's watershed you live.
- ✓ Based on the demonstration you did in which beets were used to represent leakage from waste materials, what conclusions can you draw about the practice of dumping waste material directly on the land or in a stream?
- ✓ What do you think "Out of Sight—Out of Mind" means in this context?

Journal Activity

Have students imagine they are molecules of soda pop that have leaked from a can thrown into a sinkhole. Have them write a story about their travels and who or what they might meet along the way. Encourage illustrations.

Out of Sight, Out of Mind

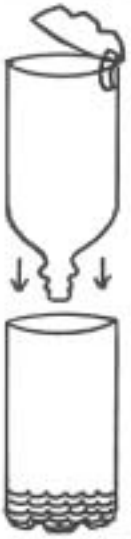
1

Make 4 demonstration columns, following steps below for each column.

Bottle #1

Cut bottom 2½" down

Tape to make hinge (as shown)



Bottle #2

Cut off top 3" down

Pour water into bottom, 2" high

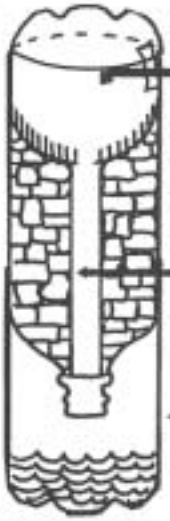
Bottle #1 will be inserted (as shown)

Completed Column

2

Prepare 2 columns, following steps below. Label them *Sinkhole A* and *Sinkhole B*.

1. Insert tube in Bottle #1, as shown.
2. Pack stones around it--higher at edges and lower in the center.
3. Lay sod on top, as shown.
4. Insert Bottle #1 into Bottle #2, as shown.



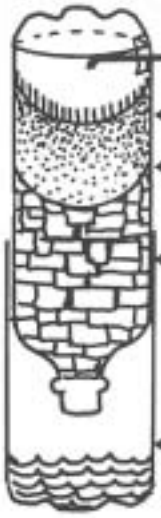
Simulated:

- Sinkhole
- Groundcover
- Underlying limestone
- Opening into caverns below
- Groundwater (underground stream or pool)

3

Prepare 2 columns, following steps below. Label them *Watershed C* and *Watershed D*.

1. Pack stones in bottle as shown--higher at edges and lower in the center.
2. Add a layer of soil, slightly packed down, higher at edges and lower in the center, as shown.
3. Lay sod on top, as shown.
4. Insert Bottle #1 into Bottle #2.



Simulated:

- Watershed
- Groundcover
- Underlying soil
- Underlying limestone
- Groundwater (underground stream or pool)

4

Conduct the Investigation.

1. On top of the sod in Columns A and C, place layers of sliced beets and their juice.
This material contains coloring that can be traced to the underground water. The beets represent trash and other waste material thrown into a sinkhole or on another part of the land in a watershed.

2. Measure equal amounts of water to sprinkle into the centers of Columns A and B and sprinkle equal amounts onto the surface of Columns C and D. (Columns C and D will require more water.) Pour enough water into the columns until it runs through to the underground water.
This represents the water that drains into sinkholes and from the watershed following a heavy rain.

Trash Town

(Adapted from the EPA Office of Solid Waste Publication "Quest for Less")

Standard

PL-M-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing).

SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.

Activity

This lesson teaches student the costs involved in proper waste management. It also helps them understand one way in which taxes are used for the good of all. .

Materials

One copy of Trash Town worksheet per student (attached), pencil and paper, calculators (optional)

Length of Lesson

One hour

Vocabulary Words

Landfill-- a site where waste is managed to prevent or minimize health, safety, and environmental impacts.
Tipping fee—A fee to bring trash to a landfill.
Recycle-- collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.

Essential Question

How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste management?

Skills Used

Computation, problem solving

Trash Town, continued

Activity

Step 1: Photocopy and distribute the *Trash Town* worksheet to each student. Introduce the following concepts to your class (refer to the teacher fact sheet titled "Solid Waste" for more information).

- ✓ It costs us money to dispose of our garbage. The more garbage we generate, the more money we pay for disposal.
- ✓ Most landfills charge a fee for accepting trash. This is called a tipping fee. Sometimes communities use tax dollars to collect and dispose of solid waste. Either way, society has to pay to get rid of its solid waste.
- ✓ We can save money by recycling, composting, reusing or reducing instead of just throwing out more and more garbage.
- ✓ We can earn money by recycling because recycled materials can be sold to manufacturers.

Step 2: Pass out calculators to each student. Ask the students to carefully read the *Trash Town* worksheet and complete the math problems related to the town's disposal and recycling practices. (Teachers may choose whether this worksheet should be completed in groups or individually.)

Step 3: Conduct a Pay-as-you-Throw (PAYT) experiment in your classroom or lunchroom. Hand out the same amount of fake money to each student and charge him or her fees based on how much they throw away each day (e.g. $1 per plastic bag, $2 per aluminum can, etc.). Keep this up for one week and see if students can reduce the amount of trash they throw away by the end of the week. The five student with the most "trash" money left at the end of the wee can "buy" prizes such as candy bars, one "free" homework assignment etc.

Step 3 (cont.)
Explain to students that over 4,000 communities already have PAYT programs where citizens are charged based on the amount of solid waste they throw away. Have students visit the website <www.lexingtonma.org/swat/info/pdf> To read how one community (Lexington, Massachusetts) is trying this approach.

Assessment

1. Collect the *Trash Town* worksheets and evaluate the computations and answers.

2. Have students write a paper comparing traditional waste disposal (tax supported landfills, tipping fees) and PAYT systems. Ask them to list at least three advantages or disadvantages to each strategy, choose which system they think is best and explain why.

$$$$$$$$$$$$$$

In Business for Yourself

Standard

Practical Living, PL-M-3.1.5, Environmental issues (e.g., pollution) should be considered when making consumer decisions (e.g., recycling, reducing, reusing).

Social Studies, SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.

Activity

In this activity, students interview people in the business community about how they deal with solid waste.

Materials

Paper and pencils, U.S. maps, questionnaires (included), and local telephone directories.

Length of Lesson

Three to four hours over several days

Vocabulary Words

Recycle-- collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.

Essential Question

How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste?

Skills Used

Interviewing, communicating, graphing, analysis

In Business for Yourself, cont…..

Activity

Step 1: Explain to students that most businesses create solid waste but most businesses dispose of solid waste properly. Explain that this happens for several reasons. First, like all citizens, most business people want to have a clean environment. Also, businesses are "regulated". In other words, there are laws governing how they deal with solid waste. The few businesses that don't follow these regulations often must pay fines. Finally, recycling or reducing solid waste is often more cost effective that just throwing it away.

Discuss different kinds of businesses with which students are familiar such as fast food, clothing retailers and grocery stores. Using the telephone directory, have students list local businesses and the kinds of solid waste that these businesses might produce.

Step 2: Tell students they are going to interview local business people about how they deal with solid waste. Review the attached questionnaire and allow students to use it as a guide to create their own set of questions.

Assign each student (or pair of students) at least one local business. Have them write to the business telling them that they will be calling in a few days to ask questions about how they deal with solid waste. (A sample letter is included.) Enclose a copy of the questionnaire in the letter so business people can have a few days to gather information that may not be readily available. (Note: you may want to assign students more than one business if possible in case the business people they are calling do not have time to be interviewed.)

Step 3: Review telephone etiquette with students and do some role-playing in which students

Step 3: (cont.) practice calling and conducting the interview.

Step 4: Have students make the calls. (Cell phones may be helpful.) Remind them to be sure and record the information they are gathering.

Step 5: Make sure students write thank you notes to business people who participated in the interviews.

Step 6: As a class, review what students have learned in the interviews. Use national and state maps to mark where some of the materials used by local businesses originate. Record all information from multiple-choice answers gathered by the class. For example, for Question #2 on the sample survey, "Where do most of your materials come from? " record the number of businesses in which the person being interviewed answered "locally"; the number who answered "Kentucky"; the number who answered "U.S."; etc. Make sure you prominently display all the responses (on chart paper or the blackboard) as well as the total number of business people who were interviewed.

Evaluation

1. Using the data gathered by the class, ask each student to figure what percentage of businesses interviewed recycle. (Divide total number of businesses that recycle by total number of businesses).

2. Ask students to explain in writing whether they think recycling is good or bad for business. Ask them to list the pros and cons of recycling in their answer.

In Business for Yourself, cont….

Sample letter to local business people concerning solid waste survey

Mr. John Doe
Best Business
Goodtown, KY 40000

Dear Mr. Doe:

My class is learning about how our citizens and our community deal with solid waste. We know that businesses have to deal with a lot of solid waste and that disposing of solid waste is part of the cost of doing business. We are trying to find out more about how businesses in our community dispose of, and recycle, solid waste and what it costs to do that.

We are conducting a survey of businesses in our community and I would like to call you to conduct the survey on (date)_____, at (time)____. If this is not convenient, could you please call me to set up another time? My number is _____.

A copy of the survey is enclosed so you can get an idea of the kinds of information we are gathering. If you have any questions, you can reach my teacher at the address below.
Teacher's name_____
School_____
School address_____
School Phone number_____

Thank you very much for your help with this project.

Sincerely yours,

(Student(s) name(s))

Journal Activity

Ask students to describe their interview with a local businessperson. Did they learn anything surprising about doing business? Would they like to go into business for themselves? Why or why not?

Extension

1. Ask students to keep a list of everything they or their families purchase in one week. Make sure the lists are as complete as possible. Then ask students to choose one product and write down everything that had to happen to produce that product and get it to the store where they bought it. (Make sure they include the energy it takes for delivery and production). Ask them to include all raw materials, manufacturing processes, transportation, packaging, etc.

2. Using the description of how their product was produced and delivered, ask them to list as many businesses as possible that were involved in the process.

3. Finally, ask if they have ideas on how packaging for the products they buy could be reduced?

In Business for Yourself, cont….

Be a Solid Waste Survivor
Middle Grades

Sample Community Business Survey

1. What kinds of materials/products does your business use or sell.
   _____

2. Where do most of these materials come from?
   ___ locally
   ___ Kentucky (where)
   ___ U.S. (where)
   ___ Overseas (where)

3. What kinds of containers are used to ship most materials to you?
   ___ cardboard boxes
   ___ wooden crates
   ___ Styrofoam or other plastics
   ___ metal containers
   ___ other (describe)

4. What do you do with the containers?
   ___ reuse
   ___ throw away
   ___ recycle
   ___ other (describe)

5. If you throw them away, how do you do that?
   ___ regular trash pick up
   ___ fee-based hauler
   ___ take them to landfill
   ___ other

6. If you pay to have your trash picked up, how much does that cost you per month?

   $_____

7. What (and how many) regulations do you have to follow in dealing with solid waste?

   _____

8. If you recycle or reuse containers, does that save your business money or cost your business money?
   _____ saves money to recycle/reuse
   _____ costs money to recycle/reuse

Getting to Know Us

(Adapted from "Waste a Hidden Resource in Kentucky")

Standard

Practical Living, PL-M-3.3.1, A range of resources and services are provided by community agencies:

- public health department
- fire department
- police department
- family resource centers
- hospitals
- nonprofit organizations (e.g., American Heart Association, American Red Cross, American Cancer Society)

Social Studies, SS-M-1.3.2, in order for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.

Activity

Students invite local people, whose jobs deal with solid waste in some way, to participate in a panel discussion on local solid waste issues.

Materials

Local telephone directories, very large post-it notes, Internet access, thank you notes

Length of Lesson

Two hours to prepare, one hour for the panel discussion and one hour to "debrief"

Essential Question

How can we, as citizens of our state and communities, analyze and evaluate the political, economic, health and environmental issues related to solid waste?

Skills Used

Interviewing, communicating, graphing, analysis

****

Getting to Know Us, cont…

Activity

Step 1: Explain to students that many people in their community and county have jobs in which they deal with solid waste issues. Tell students that in this activity they will find out who these people are and invite them to class for a question and answer session.

Step 2: Brainstorm as a class who in your community might deal with solid waste or solid waste issues. Examples might include the mayor, county judge executive, sanitation workers, solid waste coordinators, landfill operators, and owners or operators of recycling facilities. Use phone directories or the Internet to find addresses and phone numbers for these people. If student need more help, have them contact the Kentucky Division of Waste Management at (502- 564-6716 or www.nr.state.ky.us/nrepc/dep/waste/dwmhome)

Step 3: Choose a date several weeks in advance and have students write to those who will be invited (use letter written to businesspeople in previous activity as a guide). Make sure the letter asks those who are invited to RSVP. (Note: If invitees do not respond, you will have to call them to find out if they will attend.)

Step 4: Divide the class into four groups. Tell each group to write at least ten questions that they want to ask panel members. Tell them to write some questions that could be asked of any panelist (e.g. Do you recycle at home?) and some that are specific to those with particular jobs. (e.g. What do solid waste coordinators do?) Make sure that students understand that the questions must be polite and should ask for specific information.

Step 5: Have all groups put their questions on very large post it notes and put them on the board or a blank wall. Working together, students should arrange the questions in the order they think they should be asked.

Step 6: Before the day of the panel, be sure to assign some students to ask questions, some students to be recorders, others to be hosts. On the day of the panel, make sure your room (or other space) is set up so that the students can see and hear the entire panel. It would be a good idea to have large nametags for everyone. Conduct the panel. Make sure students thank guests after the panel and then write thank you notes as well.

Step 7: Have students who were recorders to write down their notes. Share those with the rest of the class. Give students a chance to "debrief" after the panel discussion. Did panelists give the answers they expected? What new information did they learn?

Assessment

Ask each student to write about the person who they thought had the most important job dealing with solid waste. Ask them to describe that person's job and give at least two reasons they thought so.

Surviving Through Service – A Culminating Event

Standard

S-M-3.5.2
S-M-3.5.4
SS-M-1.3.2
SS-M-4.4.4
PL-M-3.1.5
PL-M-3.3.2
PL-M-3.3.1

Activity

In this culminating activity, students are divided into small groups and use what they have learned in the unit to plan and implement service projects in the school or community.

Materials

Materials will differ, depending on the type of project. Volunteers may be needed to assist with service projects. You may want to contact the local solid waste coordinator and parents to alert them volunteers will be needed.

Length of Lesson

Several hours in class to prepare and then several hours outside of class to carry out the projects.

Vocabulary Words

All vocabulary learned in the unit

Essential Question

All questions in the unit

Skills Used

All skills learned in the unit

****

Surviving Through Service, cont…

Activity

Step 1: Make sure your principal, site-based council and parents know the students are going to be involved in designing service projects. Make sure you follow any rules that deal with such projects.

Step 2: Explain to students that they are going to use the knowledge they gained in the solid waste unit to design a service project that will help the community deal with solid waste problems. Tell them they will be divided into small groups and each group will decide on, plan and carry out a project. Explain that, while the project must be realistic, they must also provide a real service to the community.

Step 3: Tell students they should begin by choosing a solid waste issue they want to address. This might be littering, illegal dumping, the need to reduce solid waste at its source, etc. It may be anything they have studied in the unit. Then they must list the reasons this issue is a problem. Tell them to list as many reasons as they can think of.

For example, students might list littering as the problem they want to address. Reasons littering is a problem would include:

- Waste in streams and rivers can damage ecosystems
- Litter discourages tourism
- It costs taxpayers money to clean it up
- It can be a health hazard

Tell students they must also come up with at least one-way to address the problem.

Step4: Do some brainstorming as a class to help stimulate thinking about what kinds of projects students might plan. Tell them projects might fall into several categories. Categories might include (among others)

- Action projects (e.g., cleaning up a creek)
- Research projects (e.g. finding out which street near the school has the most litter and providing that information to the mayor)
- Educational projects (e.g., teaching younger children about a solid waste issue)

Step 4 (cont.):

- Informational projects (e.g., creating a brochure that lists all the offices in your community that deal with solid waste and what each office does.)
- Artistic projects (e.g. make a mural to put in city hall or other public building.)

Step 5: Help students think through their projects and write down their plans step by step, then list all materials and assistance they will need. Make sure all students have a chance to participate in both planning and implementation.

If projects will be outside of school, make sure parents are aware of the projects and give permission for their children to participate.

Step 6: Students carry out projects.

Extension

Set aside a class period for students to share their experiences and any products they have created. (Note: students who have done action projects should take photos of their project and may even want to put them into a PowerPoint presentation.)

Make sure that each group includes a discussion of the problem and the reasons they chose this problem to address.

Invite local media, parents, and local officials to the sharing session.

Assessment Rubric for Middle Grades Unit Culminating Project

4	**Students create a plan that identifies at least one solid waste issue and at least three reasons this issue is a problem in their community. Their plan identifies a service project that would address this problem and they carry out the service project. The project creates a product (brochure, PowerPoint, photo essay, research report) that can be used to promote better solid waste practices in the community.**
3	**Students create a plan that identifies at least one solid waste issue and at least two reasons this issue is a problem in their community. Their plan identifies a service project that would address this problem and they carry out the service project.**
2	**Students create a plan that identifies at least one solid waste issue and at least one reason this issue is a problem in their community. Their plan identifies a service project that would address this problem and they carry out the project.**
1	**Students create a plan that identifies at least one solid waste issue and at least one reason this issue is a problem in their community.**
Notes	

Glossary of Terms

Glossary of Terms

This glossary defines unfamiliar terms specifically related to solid waste and the environment; some words listed in the activities under "Vocabulary" will not be found in this glossary.

Aerobic—with oxygen. During the composting process, certain bacteria need oxygen to break down the mix of organic materials. This is known as aerobic decomposition.

Anaerobic—without oxygen. In a landfill, certain bacteria decompose organic materials without oxygen and create methane gas through a process known as anaerobic decomposition.

Ash (also **combustion ash**)—solid residue that remains after the combustion, or burning, of waste.

Backyard composting—the homeowner's practice of collecting leftover kitchen scraps (excluding meats and fats) and yard trimmings for decomposition in a private compost pile. Backyard composters can use their compost as a soil enhancement for their gardens.

Bacteria—single-celled microorganisms. Certain types of bacteria break down organic materials (using an ***aerobic*** and/or ***anaerobic*** process).

Bedding—organic material, such as shredded newspaper, used to retain moisture and allow proper air circulation and drainage to provide a healthy environment for worms in a ***vermicomposting*** container.

Biodegradable—materials that can ***decompose***, usually by bacteria or sunlight, into basic components. Most organic materials (paper, grass clippings, food scraps), under the right conditions, are biodegradable.

Biodiversity (also **biological diversity**)—indicated by the numbers of different species of plants and animals found in a natural environment. Many different species of plants and animals within an ecosystem is indicative of a healthy environment.

Brownfields—abandoned or unused industrial and commercial land that cannot be developed or expanded because of real or perceived contamination with toxic substances.

Bulk—when food or other products are sold unpackaged or in large volumes to reduce packaging waste. Consumers who buy one large bottle of juice rather than many small containers of juice, for example, are "buying in bulk."

Byproduct—excess material or waste produced in addition to the primary product. Sludge is a byproduct from the manufacture of paper, for example. Many manufacturers look for innovative ways to reuse or recycle the byproducts created during the production process to reduce waste.

Castings—manure from red wriggler worms that can be used as a soil conditioner to provide aeration, drainage, and nutrients to soil.

Climate—the average course or condition of weather over a period of years based on conditions of heat and cold, moisture and dryness, clearness and cloudiness, wind and calm, applied to a specific location or globally. Southern Florida, for example, has a sunny, dry, warm climate.

Closing the loop—purchasing products made from recycled materials. Recycling is a cycle. It is not enough simply to collect recyclables for manufacture into new products. People must then buy products made with recycled content, thus closing the loop.

Combustion/Incineration—a rapid chemical process that produces heat, gas, ash, and usually light through burning. This process is one option for the ***disposal*** of ***municipal solid waste***. It can also be used as a treatment or disposal option for hazardous waste. See ***combustor***, ***waste-to-energy***.

Combustor/Incinerator—a facility for the controlled burning of waste. Burning municipal solid waste can reduce its volume and weight. Some facilities capture energy from the steam or heat that is produced during the burning process. (See ***waste-to-energy***.) Burning hazardous waste can be considered a form of treatment and can reduce the hazardous components of the waste.

Compaction—the act or process of pressing materials together to occupy the smallest volume possible; a common practice at a ***sanitary landfill***.

Compost—a crumbly, earthy, sweet-smelling mixture of decomposing organic matter (e.g., leaves, food scraps) created in a controlled, ***thermophilic*** environment that is often used to improve the texture, water-retaining capacity, and aeration of soil.

Composting—the controlled biological decomposition of organic material under ***aerobic*** or ***anaerobic*** conditions. Organic materials are broken down (***decomposed*** by microorganisms) into compost, also known as ***humus***. Composting can occur in a backyard bin, a pile, long ***windrows***, or in a ***vermicomposting*** container.

Conservation—the protection or wise use of natural resources that ensures their continuing availability to future generations; the intelligent use of natural resources for long-term benefits.

Consumption—the amount of any product or resource (e.g., material or energy) used in a given time by a given number of consumers.

Contamination—the process of adding one substance to another substance, such as as motor oil to water, that reduces its quality; to make impure or unsafe by contact with potentially harmful substances.

Corrosive—a substance capable of dissolving or breaking down other substances (especially metals) or causing skin burns. A corrosive has a ***pH level*** below 2 or above 12.5.

Decompose—to break down into basic components, given the right conditions of light, air, and moisture; refers to materials such as food and other plant and animal matter.

Deforestation—the clearing and removal of trees from a forested area.

Disposable—products or materials that can be or are usually thrown away after one use or a limited amount of time. For example, used paper plates are disposable.

Disposal—refers to the process of throwing away unwanted materials. These materials are placed in a landfill or combusted rather than recycled, reused, or composted.

Disposal cell—a fixed area in a ***sanitary landfill*** where waste is disposed of, compacted into the smallest space possible, and then covered with soil on a daily basis.

Durable—goods that can be used more than once and withstand long use, wear, and decay. Appliances are examples of durable goods.

Dump—site where waste is disposed of in an unmanaged, uncovered area. Current landfill restrictions have made dumps illegal. See sanitary landfill.

Ecosystem—community of plants and animals that interact with one another and with the surrounding nonliving environment. Examples of ecosystems include ponds, forests, and beaches.

Effluent—waste material discharged into the environment; refers to the treated liquid emitted from a manufacturing facility or municipal wastewater treatment plant.

Emission—the discharge of gases or particles, such as from a smokestack or automobile engine.

Energy—capacity for a system or an object to do work (i.e., cause a change by pulling, pushing, or heating). Energy generated from incineration, for example, can be harnessed to provide electrical power for communities.

Environment—the external conditions that influence the development and survival of an organism or population; usually refers to air, water, land, plants, and animals.

Environmental impact—the effect of an activity or substance on the environment.

Environmentally preferable products—those products that have a reduced effect on human health and the environment when compared to other products that serve the same purpose.

For example, products that contain recycled content, require less energy or create less waste during production and manufacture, use less packaging, or are reusable or recyclable are preferable.

Flammable—describes a substance that ignites and burns.

Food chain—the transfer of food energy from one organism to the next. As one example of a simple ***food chain***, an insect consumes a plant and is then consumed by a bird.

Food web—the complex and interlocking networks of food chains within ecosystems where plants and animals coexist and depend on one another for energy needs.

Fossil fuels—fuels such as petroleum or coal formed over millions of years from the remains of ancient organic materials.

Geothermal energy—the internal heat of the earth collected from underground concentrations of steam or hot water trapped in fractured or porous rock.

Global climate change—natural or human induced change in the average global temperature of the atmosphere near the Earth's surface. This condition poses serious dangers around the world, potentially prompting such disasters as flooding, drought, and disease.

Grasscycling—refers to a method of ***source reduction*** whereby grass clippings are left on the lawn rather than bagged and set out for collection.

Greenhouse effect—the excessive trapping of heat in the Earth's atmosphere by a blanket of gases. Gases such as water vapor, methane, and carbon dioxide exist naturally and help retain the Earth's normal surface temperature. Changes in the normal volume of gases in the atmosphere, due to human-induced activities, are believed to contribute to ***global climate change***.

Greenhouse gas—gas such as methane, nitrous oxide, ammonia, sulfur dioxide, carbon dioxide, and certain chlorinated hydrocarbons that affects the overall heat-retaining properties of the Earth's atmosphere. A build-up of these gases creates a warming of the Earth's atmosphere, thus changing the global climate.

Ground water—water stored in porous spaces of soil and rock underground. Many communities depend on ground water for their drinking water.

Habitat—an area where a living organism is typically located that provides adequate food, water, shelter, and living space for survival.

Hazardous waste—waste that is often produced in large quantities by businesses and industrial facilities that can be defined as ***toxic***, ***ignitable***, ***corrosive***, or ***reactive***. This type of waste is regulated by a law called the Resource Conservation and Recovery Act (RCRA) to

minimize risks to human health and the environment.

Household hazardous waste—small quantities of unused or leftover hazardous products used in the home that become waste. Paints, pesticides, and some cleaners are examples of household hazardous waste. Caution must be taken when handling, storing, or disposing of these products.

Humus—the organic portion of soil; a substance resulting from the decay of plant and/or animal matter by microorganisms.

Ignitable—capable of burning; will catch fire at temperatures less than 140º F.

Incineration—see combustion/incineration.

Incinerators—see ***combustor/incinerator***.

Integrated waste management—the complementary use of a variety of waste management practices to safely and effectively handle municipal solid waste. These practices include source reduction, recycling, composting, combustion, waste-to-energy, and landfilling.

Landfill—see ***sanitary landfill***.

Landfill reclamation—the process whereby old disposal cells are excavated to recover recyclable items.

Landfilling—the process of hauling waste to a landfill cell for disposal.

Leachate—occurs when precipitation seeps through a landfill and mixes with toxic and nontoxic liquids, some of which are created during biological ***decomposition***. A ***sanitary landfill*** usually has a leachate collection system where leachate is collected from the landfill and treated to prevent the ***contamination*** of ***ground water***.

Leachate collection system—a system of layers and pipes, located between the primary and secondary liners in a landfill, designed to capture all leachate and prevent groundwater contamination.

Leachate recovery facility—a special facility designed to collect liquids leaching out of a landfill to remove harmful or particulate materials.

Life cycle—the complete cycle of events occurring over the lifetime of an animate or inanimate object. For example, in the life cycle of a plant, seeds are dropped in the ground; soil, water, and compost help the plants grow; the plants drop seeds; the plants die and become ***compost***; new seeds grow into new plants. A product life cycle is the series of steps involved in manufacturing; distributing; using; reusing, recycling, or ultimately disposing of

a product.

Liner—a layer of plastic or clay placed in a sanitary landfill to prevent leachate from escaping and contaminating surrounding ground water.

Manufacturing—the process of turning raw materials into a product or good by hand or machinery.

Methane—a colorless, odorless, flammable gas formed by the ***anaerobic*** decomposition of organic waste in a landfill. Methane also is a ***greenhouse gas*** that contributes to ***global climate change***. Many ***sanitary landfills*** have a system in place for methane gas recovery. These facilities collect some of the methane and sell it as a source of energy for heating buildings, manufacturing products, or other uses.

Microorganisms—organisms of microscopic size, such as bacteria, amoeba, and viruses.

Municipal—properties, goods, and services owned or operated by a city or county government.

Municipal solid waste—wastes such as ***durable goods***, ***disposable goods***, containers and packaging, food scraps, ***yard trimmings***, and miscellaneous inorganic wastes from households, some commercial establishments (e.g., businesses or restaurants), institutions (e.g., schools or hospitals), and some industrial sources. It does not include nonhazardous industrial wastes, sewage, agricultural waste, hazardous waste, or construction and demolition waste. Also known as garbage, trash, refuse, or debris.

Municipal solid waste landfill—see ***sanitary landfill***.

Natural resources—raw materials or energy supplied by nature and its processes (e.g., water, minerals, plants). Trees are a natural resource used to make paper, and sunlight is a natural resource that can be used to heat homes.

NIMBY (Not In My Backyard)—a term indicating the attitude of individuals who oppose siting a disposal facility in their communities.

Nonrenewable resources—naturally occurring raw materials that are exhaustible and become depleted more quickly than they naturally regenerate. Some nonrenewable resources, such as peat, petroleum, and metals, are only available in limited quantities, take a long time to form, and are used up rapidly.

Nontoxic—does not contain substances that are harmful, poisonous, or destructive.

Oil (crude oil)—unrefined liquid ***petroleum***.

Open dumps—the outdated, unsanitary practice of discarding waste in unlined, unprepared land sites.

Organic—from a living organism (e.g., plant, animal, person, or bacteria). Also refers to a product grown or manufactured only with natural materials (e.g., corn grown with compost and not chemical fertilizer or pesticides; shampoo made from plants instead of human-made chemicals).

Organism—a living body made up of cells and tissue; examples include trees, animals, humans, and bacteria.

Packaging—a cover, wrapper, container, or stabilizer (e.g., strapping or pallet) designed to store, transport, display, and protect a product and/or attract purchasers.

Pathogen—an organism that causes disease, such as e. coli or salmonella typhi bacteria.

Pay-As-You-Throw (PAYT)—see unit-based pricing.

Petroleum—a fossil fuel extracted from natural deposits deep in the Earth; consists of a mixture of solids, liquids, and gases that are physically separated (refined) into products such as gasoline, wax, asphalt, and petrochemical feedstocks, which are the building blocks of many plastics. Also sometimes known as oil (crude oil).

pH—a measure of acidity or alkalinity. The pH scale ranges from 0 to 14. A substance with a value less than 7 is acidic, 7 is neutral, and above 7 is alkaline.

Pollutant—a liquid, gas, dust, or solid material that causes contamination of air, water, earth, and living organisms.

Pollution—the contamination of soil, water, or the atmosphere by the discharge of harmful substances.

Pollution prevention—preventing or reducing pollution where it originates, at the source—including practices that conserve natural resources through increased efficiency in the use of raw materials, energy, water, and land. See waste minimization.

Postconsumer content—percentage of materials recovered by consumers (from the municipal solid waste stream). For example, a newspaper might be made from 30 percent recovered newsprint.

Postconsumer materials—materials recovered through recycling programs (i.e., materials recovered from the municipal solid waste stream, not from internal industrial processes). These materials are often used to make new products. Newspapers that are recycled by consumers, for example, are a postconsumer material used to make newsprint.

Preconsumer content—percentage of materials salvaged for reuse from the waste stream of a manufacturing process (rather than from consumers) subsequently used to manufacture a product.

Processing—see manufacturing.

Product—item manufactured by hand or by industry for consumers to purchase and use.

Pulp—a mixture of fibrous material such as wood, rags, and paper, ground up and moistened to be used in making paper or cardboard.

Raw materials—unprocessed materials used in the manufacture of products. These unprocessed materials can be either natural substances such as wood or metals or recovered materials such as crushed glass from residential recycling.

Reactive—tending to react spontaneously with air, solids, or water, explode when dropped, or emit toxic gases.

Recovered material content—see ***recycled content***.

Recovered materials—materials used in a manufacturing process that are obtained from municipal recycling programs or collected from industrial processes (e.g., short paper fibers left over after making high-grade paper may be used to make paperboard).

Recovered resources—see ***resource recovery***.

Recycling—collecting, sorting, processing, and converting materials that would have been thrown away into ***raw materials*** used to make the same or new products.

Recycling loop—the cycle of collecting and processing, manufacturing products with recycled content, and purchasing products containing recycled materials. Consumers "close the recycling loop" when they buy recycled-content items.

Recycled content—also known as recovered material content, is the percentage of material a product is made from that has been recovered from consumers in the ***municipal solid waste*** stream (***postconsumer content***) plus any industrial materials salvaged for reuse (***preconsumer content***).

Recyclable—material that still has useful physical or chemical properties after serving its original purpose and can be reused or remanufactured to make new products. Plastic, paper, glass, steel and aluminum cans, and used oil are examples of recyclable materials.

Residential—refers to homes and neighborhoods.

Resource Conservation and Recovery Act (RCRA)—a set of regulations that control the management of hazardous waste to protect human health and the environment.

Resource recovery—the process of obtaining materials from waste that can be used as raw materials in the manufacture of new products or converting these materials into some form of fuel or energy source. An integrated resource recovery program may include recycling,

waste-to-energy, composting, and/or other components.

Resources—materials used to make products, generate heat, produce electricity, or perform work. See ***natural resources***, ***nonrenewable resources***, and ***renewable resources***.
Renewable resource—naturally occurring raw material that comes from a limitless or cyclical source such as the sun, wind, water (hydroelectricity), or trees. When properly used and managed, renewable resources are not consumed faster than they are replenished.

Reusable—material that can be used again, either for its original purpose, or for a new purpose.

Reuse—a type of ***source reduction*** activity involving the recovery or reapplication of a package, used product, or material in a manner that retains its original form or identity.

Runoff—water, usually from precipitation (rain), that flows across the ground—rather than soaking into it—and eventually enters a body of water. Sometimes carries substances, such as soil or contaminants, into a water body.

Sanitary landfill—a site where waste is managed to prevent or minimize health, safety, and environmental impacts. To develop a sanitary landfill, communities excavate soil and install an impermeable liner, made of plastic or clay, to prevent the contamination of ***ground water***. Waste is deposited in different cells and covered daily with soil. Sanitary landfills often have environmental monitoring systems to track performance and collect ***leachate*** and ***methane gas***. Some landfills are specially designed to handle hazardous waste.

Solid waste—see ***municipal solid waste***.

Source reduction (also known as **waste prevention**)—any change in the design, manufacture, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they become ***municipal solid waste***. Source reduction also refers to the ***reuse*** of products or materials.

Sustainability—social and environmental practices that protect and enhance the human and natural resources needed by future generations to enjoy a quality of life equal to or greater than our own.

Thermophilic—"heat loving," or surviving well in high temperatures. In the composting process, heat-loving microorganisms break down food scraps and yard trimmings into a crumbly, soil-like substance.

Tipping fee—a fee assessed for waste disposal in a sanitary landfill, waste-to-energy plant, or composting facility for a given amount of waste, usually in dollars per ton. Fees are established based on disposal facility costs and the amount disposed of at the facility.

Toxic—containing compounds that pose a substantial threat to human health and/or the environment.

Unit-based pricing/PAYT (Pay-As-You-Throw)—a system in which residents pay for municipal solid waste management services per unit of waste (by weight or volume) collected rather than through a fixed fee. Residents, for example, might purchase a sticker to place on each bag of waste set out at the curb—the price of the sticker covers the solid waste management service costs for the volume of the bag.

Vermicomposting/vermiculture—a method of composting using a special kind of earthworm known as a red wiggler (Elsenia fetida), which eats its weight in organic matter each day. Over time, the organic material is replaced with worm castings, a rich brown matter that is an excellent natural plant food.

Virgin materials—previously unprocessed materials. A tree that is cut into lumber to make pallets is an example of a virgin material. Lumber recovered from broken pallets to make new pallets is not a virgin material but a ***recyclable material***.

Virgin resources—raw materials that must be mined or captured from the Earth for use in the creation of products or energy.

Waste—see ***municipal solid waste***.

Waste management—administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of waste.

Waste management hierarchy—the preferred way to manage solid waste is to first practice ***source reduction***, then recycle and compost, and finally to combust waste at a ***waste-to-energy*** facility or place it in a ***sanitary landfill***.

Waste minimization—includes reducing waste before it is even generated (see ***source reduction***) and environmentally sound recycling. Often used in relation to hazardous waste.

Waste prevention—see ***source reduction***.

Waste-to-energy—a process in which waste is brought to a facility and burned to generate steam or electricity.

Waste-to-energy facilities—specially designed waste management facilities where waste is burned to create energy, which is captured for use in generating electricity.

Waste stream—the total flow of solid waste generated from homes, businesses, and institutions that must be recycled, incinerated, or disposed of in landfills.

Windrow—large, elongated pile of ***yard trimmings*** or other organic materials used in the

composting process, typically turned by a machine. Municipal composting programs often use windrows for large-scale composting of ***yard trimmings***.

Yard trimmings—grass, leaves, tree branches, brush, tree stumps, and other compostable organic materials that are generated by homes, schools, or businesses.

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